Gas Journal

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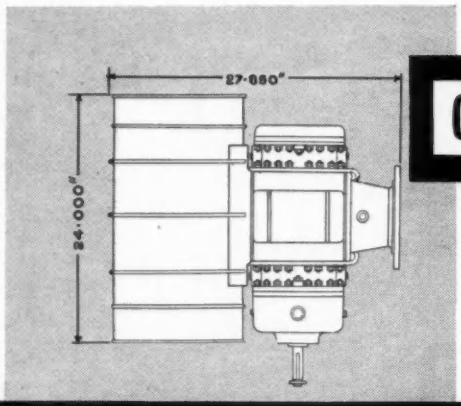

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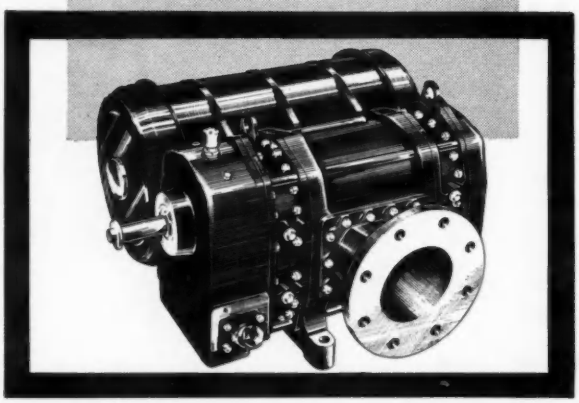

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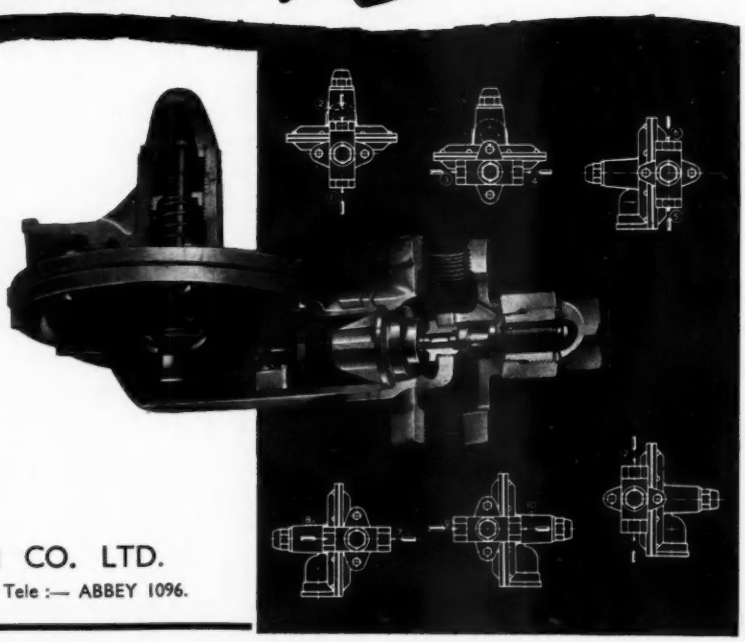
FULL DETAILS ARE GIVEN IN OUR PUBLICATION G/81.



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Gas Journal

IIITH YEAR
VOL. 300 No. 5025 DECEMBER 23, 1959

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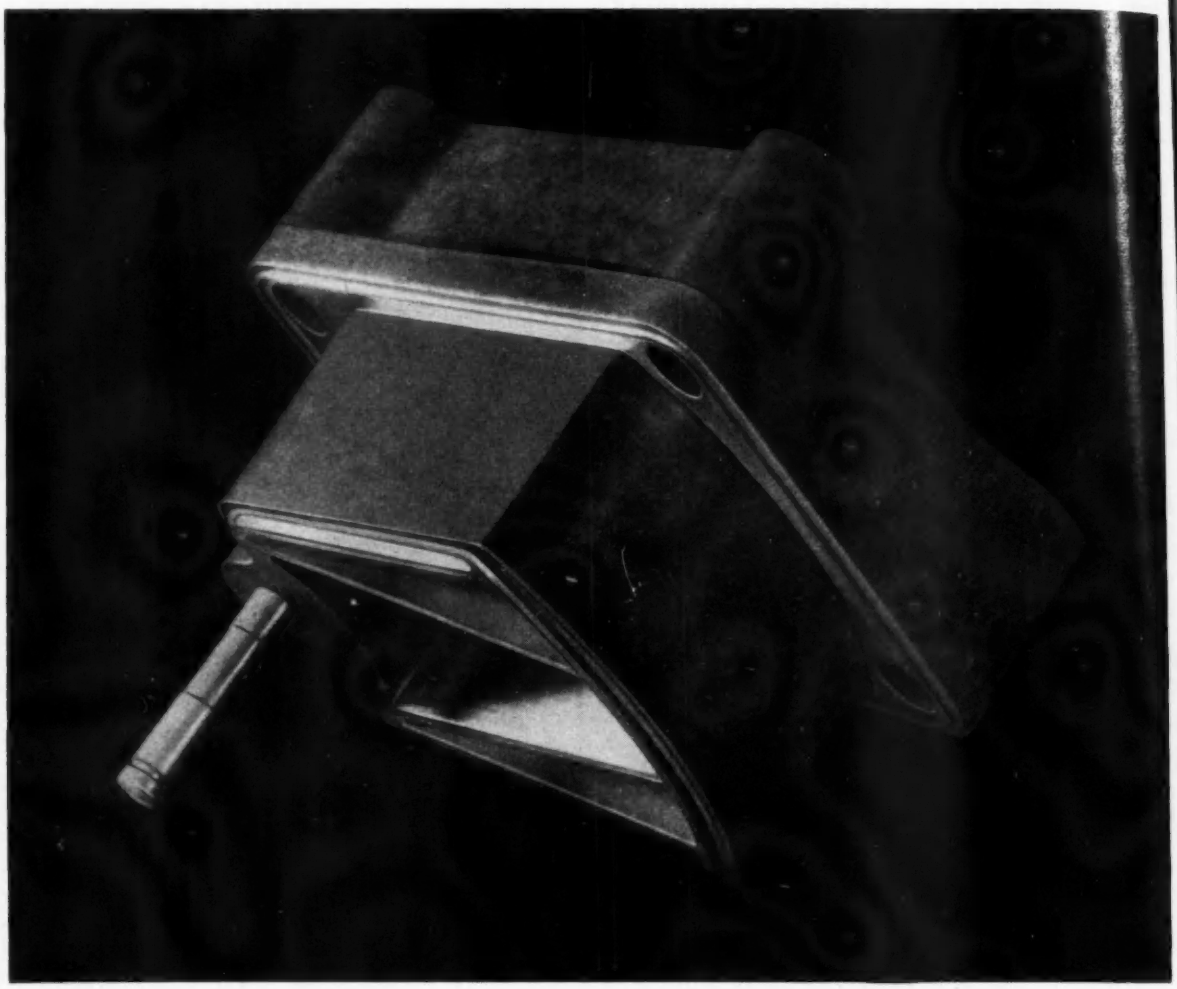

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Gas Journal

VOLUME 300 No. 5025 DECEMBER 23, 1959 111th YEAR

Hot Air at Harlow

OF the many developments which have had their effect upon the gas industry it is doubtful whether any has been more warmly received and rapidly promoted as the warm air method of heating. It came at a time when the industry was desperate for something which would combat electric floor warming and other forms of competition, and as a result, instead of inducing the reactionary murmers which have greeted many another equally worthwhile innovation everyone set to in a desire to explore the possibilities, train sales personnel and get the story over to architects, builders, and, of course, the public in the shortest possible time. There is still a very long way to go but excellent progress is being made and a growing number of installations bear witness to the soundness of the scheme and are providing in themselves a first-class advertisement.

Last week we had a look at various installations of Sugg Halcyon heaters in Harlow New Town where they appear to be attracting the right sort of attention and giving every satisfaction to the users. Two of these installations were of particular interest in that they embraced Halcyons and Ascot 727 multipoints attached to SE-Ducts.

The first of these was in Edmund's Tower, a 12-storey block of 46 flats which has already been inspected by some 50 official parties from France, Germany and all parts of the United Kingdom. We hope the visitors were impressed by the space heating and water heating service provided, but we could not help wishing that the basic design of the flats had been more conducive to showing these gas appliances at their best. It is not part of our function to assess the New Town from an aesthetic standpoint, and even matters of fundamentally impractical design must be left for others to comment on; but when those aspects of design impinge upon the part played by gas then they become our legitimate concern.

Thus we must express our disappointment at the fact that in Edmund's Tower, which is no doubt architecturally interesting and even progressive in its way, the Halcyons are so positioned that only one of the three warm air outlets discharges into an actual room (the lounge), the remaining two discharging into the tiny hall. This means that if the tenant requires to heat the bedroom, bathroom or kitchen he must leave the door open. We mention this not as a criticism of the Eastern Gas Board because so far as we can judge the Board has shown the greatest enthusiasm for getting new business of this type and taken the utmost care in carrying out the installation. No, the fault lies with the architect who has failed to make proper use of this attractive and flexible heating system. To this extent he has done gas a disservice and it is to be hoped that future occupants of the flats will not blame gas for any inconvenience they may suffer. The situation is not helped by the fact that the kitchen appears to have been designed with the express purpose of ensuring that the tenant cannot find room for either a refrigerator or a washing machine.

All this is a pity in view of the fact that from the point of view of operating efficiency the Halcyon—Ascot—SE-Duct combination appears to function extremely well, providing a practical example of how simply flats of this kind can be served, the tenants remaining in full control of the service provided and the running costs. Fortunately the shortcomings in design to which we have referred do not apply to the other block of flats equipped with a similar system. This four-storey block of 16 flats is occupied and we were left in no doubt of the tenants' satisfaction with the service provided. Equally satisfactory to the tenants are the four adjacent bungalows equipped with Halcyon heaters and Ascots.

Money talks these days and the estimated running costs—the installations have not been working for a full heating season—are significant. In Edmund's Tower the capital cost of appliances (including thermostat and automatic switch) and SE-Duct is about £130 per flat (floor area 450 sq. ft.), and the running costs, averaged out over 52 weeks, are estimated at 11s. In the four-storey flats (floor area 560 sq. ft.) the figure is 12s. and in the bungalows (floor area 360 sq. ft.) 11s. Running costs such as these in respect of a very full heating and water heating service should interest any architect and we were very pleased to note that the Gas Board had a scheme working whereby tenants could pay weekly by means of stamped cards. In this way the greater expense incurred in the winter is evened out over the year. It is also good to know that certain of these installations will

We Wish All Our Readers a Happy Christmas

be instrumented and the results of the survey made available to all interested parties.

There are three tower blocks in Harlow. The first was 'all-electric,' the second had electric water heating but gas space heating, and the latest, Edmund's Tower, has gas water heating and gas space heating. Small wonder that the Board Chairman, Mr. John Dyde, remarks: 'As a man full of "confident tomorrow" I regard this as natural progression.'

We have devoted a good deal of space to the part gas is playing at Harlow New Town—the Gas Board has already put £1.5 mill. of capital into the town and is getting at least 75% of the cooking business—but this is not an isolated case. In many places all over the country gas is showing its new-found virtues and advantages and the architectural and building professions are taking note. Warm air heating is beginning to gather momentum. The future could be very bright indeed.

Lament for Mond

SUPER gasworks, the Lurgi variety included, are all very well so far as they go, but they strike a cruel blow at the industrial antiquarian. Scores of fascinating little works full of delightfully historic and eccentric detail have been swept away during the past ten years, often without widespread notice, so that by the time the enthusiast prepared for a nostalgic visit, it was too late. Such thoughtlessness cannot be attributed to the West Midlands Gas Board who have thoughtfully given the antiquarians three or four years' notice of their intention to close that oddest of all works, the South Staffordshire Mond gasworks. We do not seriously suggest that more than a handful of the works' 200 large industrial consumers will lament its passing on sentimental grounds, but they may well do so on the grounds that the new Lurgi plant at Coleshill is unlikely to provide them with gas at the attractive figure of 1s. 3d. a therm. But the Board will no doubt convince them of the virtues of a gas which, if it costs another penny or two, will be undeniably cleaner and richer.

The brainchild of Ludwig Mond, who developed the works to provide a source of supply of ammonia for the ammonia soda process, this curious plant at Dudley Port became a producer of gas as a prime motive when other forms of ammonia manufacture undermined the profit obtained from the main product. Many of the by-products were played down on nationalisation but cordage preservative and paint continue to furnish worthwhile revenue.

Like an elderly motor car, the works has been an expensive contrivance to keep in running order, and although the Board may share our heartache at the forthcoming demise of the old thing they will no doubt be compensated by a feeling of satisfaction in the region of the bank balance.

Who Speaks for Gas?

NO longer do the correspondence columns of certain of our more serious newspapers merely provide a sounding board for individual opinion; they are being used as a battlefield for competing business interests. There is nothing intrinsically wrong in this—provided, as usually happens, that the letters published are of interest, and possibly of benefit, to readers.

We do not have statistics available, but we are prepared to wager that the subject most discussed is fuel. Some of the opinions expressed stem from private individuals, but many emanate from the electricity, oil and solid fuel industries, writing either officially or using a private individual as a mouthpece. So great is the nation's dependence on the proper use of fuel, and so important is the part it plays not only in leading us to a higher standard of living but in the household budget that a great many people follow these letters attentively, hoping some pointer will emerge which will assist them in choosing the most economical fuel and appliances for their own requirements.

If zeal is any criterion of success then the prize must go to the Coal Utilisation Council whose indefatigable Director, Mr. J. S. Williams, never misses a chance of putting in a few words of the solid fuel story. And why not? His job is to promote the sale of solid fuel, notably coal, and because he does so with ingenuity and persistence we admire him for it. Would that the gas industry had as able a champion!

Which brings us to the theme of this item—who speaks for gas? The fact is that in all this correspondence the gas industry is conspicuous by its absence and the most glaring errors are allowed to pass unchallenged, doing untold harm to our interests. A few days ago a leader in the *Financial Times* claimed that 'an experimental Lurgi plant has been working for some time at the giant opencast coal site of Westfield'—absolute nonsense, but nobody bothered to correct the statement and by so doing introduce a word or two to explain the industry's aims. A few days previously the correspondence columns of the same paper contained side by side two letters criticising gas fires; one correspondent described them as 'an expensive form of heating' and the other as 'inclined to be dirty, inclined to be noisy, monotonous to look at and to listen to.' Another day a correspondent complained that gas-fired central heating was very expensive—and so one could go on. How can gas make the grade if this sort of thing goes unanswered? Why doesn't the Gas Council ensure that gas has a spokesman too?

Gas at Work in Industry

IN view of their importance to the industry and the proportion of gas sales for which they are responsible, industrial gas engineers are a quiet lot, seldom given to publicising their efforts and achievements. This is due not so much to modesty as to the fact that they are few in number and are nearly always too busy to think about anything except meeting the needs of their consumers. Occasionally, however, they break out and bang the drum. They did so in 1957 when four area boards—Eastern, North Thames, South Eastern and Southern—jointly sponsored a highly successful exhibition in London. Now the same four boards are to repeat the dose and as a result 'Gas at Work in Industry' will be held at the Royal Horticultral Hall, Westminster, from March 1 to 12.

How gas continues to meet the demands of modern industry will be demonstrated by working plants, models, photographs, films, etc. After all, atomic energy, radar, television, aircraft, and rockets are among the industries which make use of gas, and you cannot get much more up to date than that! There will be demonstrations of metal melting, tinning, diecasting, and special purpose plant for the clean heat treatment of metals. Another feature will be the vitreous enamelling of aluminium, of special interest as it will employ plant of new design. Drying operations by means of direct and indirect plant will be seen, and an infra red plant will carry out paint finishing operations. Processes used in the clothing industry will be demonstrated and a model bakery will be producing both bread and confectionery.

Scottish tariff—deputation to Board Chairman

MR. SIDNEY SMITH, Chairman of the Scottish Gas Board, met a deputation from the Scottish Housewives' Association in Edinburgh recently to discuss the Board's new tariff structure, introduced in August.

The deputation, which had requested the meeting, said there was great public resentment at what were termed 'meter charges' under the Board's new tariff. Mr. Smith denied that there were any meter charges and said this was a wrong interpretation of a standing charge to meet rising maintenance costs, decided in consultation with the consumers' consultative council.

The housewives replied that 'it might have been more honest to make an increased cost per therm than to levy a charge of 6s. 6d. per slot meter and 4s. 4d. per ordinary meter (both per quarter) which has, naturally, led the consumers to assume that this is a meter charge.' The Board, they added, was very badly advised by its consultative council 'in trying to mislead the public.'

TECHNOLOGISTS COLLEGE AWARDS

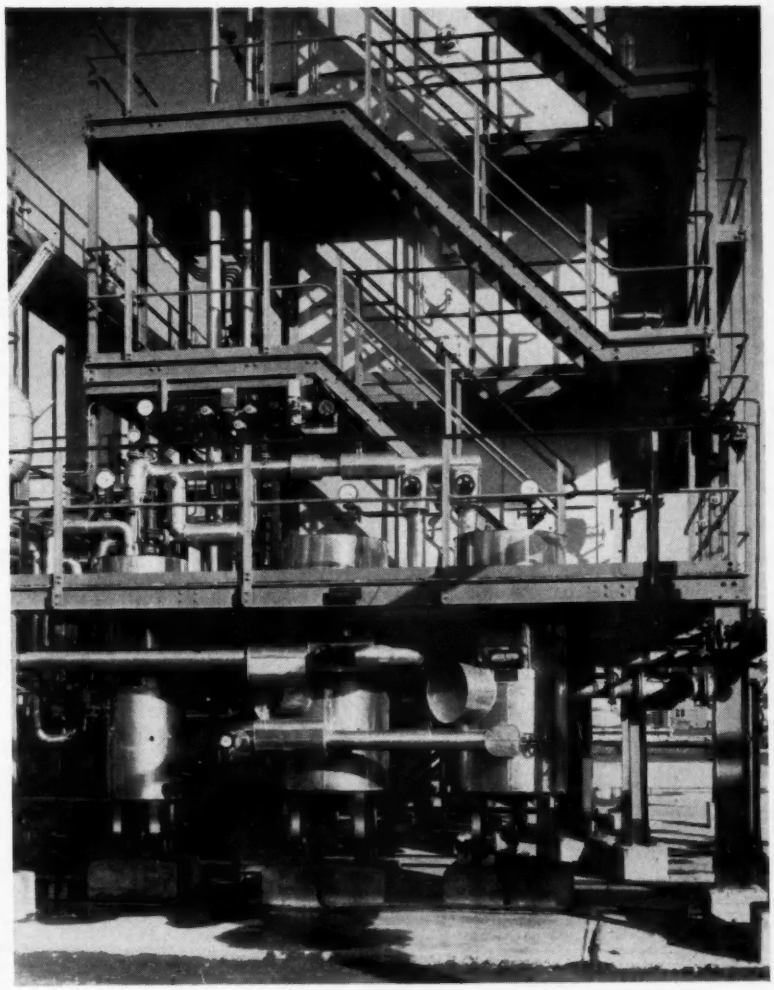
ARRANGEMENTS for the award of Member of the College of Technologists (M.C.T.) were announced last week by the National Council for Technological Awards. This award follows the Diploma in Technology and is given to those who complete a substantial programme of work of value to industry carried on jointly in industry and a college.

Lord Hives, Chairman of the National Council and of the Court of Governors of the College of Technologists, commenting on the arrangements said, 'The new higher award, with its own distinctive features, provides a qualification in the field of technology equivalent to the Ph.D. degree of a university and will be welcomed by students, technical colleges, and industry alike.'

SALES CONFERENCE ENGINEERS VISIT

DURING a sales conference held by W. C. Holmes & Co. Ltd., at the end of November, attended by sales engineers from all parts of the country, a full day was set aside for a visit to the Bushbury works of the Electric Construction Co. Ltd.

The Holmes' party, which was led by Mr. B. J. Duncan, Field Sales Manager, and Mr. M. D. Auchterlonie, Birmingham Office Manager, was met by Mr. J. D. Noble, Technical Manager—Rectifier/Electronics, and members of his staff. The party later met the Managing Director of the Electric Construction Co. Ltd., Mr. J. C. Milne.



A typical P.G. Hercules reforming furnace. Installed by P.G. Engineering Ltd. for industrial applications.

NATURAL GAS REFORMING PLANT FOR WHITBY GASWORKS IN EARLY 1960

P. G. ENGINEERING LTD. (member of the Power-Gas Group), Stockton-on-Tees, has received instructions from the North Eastern Gas Board to build a plant, at the Whitby gasworks, to reform natural gas. The installation will be the first of its kind for this application in this country.

Hercules furnaces

The plant will comprise three two-tube P.G. Hercules furnaces (two working and one standby) and will be designed to produce a total of 1.25 mill. cu.ft. of town gas per day.

Alternative use

The natural gas will be obtained from wells on the North Yorkshire Moors near by and in the event of failure of this supply the plant will also be capable of producing town gas by the re-forming of commercial butane.

The plant is due for completion by July, 1960.

Canadian testing fees to be reduced in 1960

'TESTING fees for new gas-fired appliance models will be reduced by 10% for the coming year,' said Mr. W. H. Dalton, Managing Director of the Canadian Gas Association on December 7.

Pointing out that this was the minimum reduction manufacturers of gas equipment could expect, Mr. Dalton said: 'The 10% figure is based only on an average of all models processed through our laboratories. In many cases, this reduction will amount to more than 10%.'

COMPANY MEETING

CANNON (HOLDINGS) LIMITED

AN ANXIOUS AND ADVENTUROUS YEAR

Continued expansion financed from earnings

MR. A. F. OATLEY ON PURCHASE TAX DISCRIMINATION

THE 25th ordinary general meeting of Cannon (Holdings) Limited was held on December 21 in Birmingham, MR. A. F. OATLEY (Chairman and Managing Director) presiding.

The following is his circulated statement:

I have pleasure in presenting the Annual Accounts, together with your Directors' Report, for the year ended June 30, 1959, which are self-explanatory.

The result for the year is much better than indicated by the Trading Figures at the end of September, 1958, when the continued imposition of Credit Control and high rates of Purchase Tax seriously affected our business and would have involved the Company in a substantial loss by the year end.

Anticipating this, and with the objective of gaining a greater part of the much reduced demand for Cookers, we decided to produce and launch a new product in the second half of the Financial Year.

Relaxation of credit control

With the lifting of Credit Control, however, the production and launching date of this new appliance was put back, and immediate steps were instituted to re-build our labour force, increase output of existing models, and take advantage of the greatly increased demand for Cookers.

At the time we were carrying large finished goods stocks, and substantial unbalanced, unfinished parts stocks, which the introduction of a new model would have made obsolete and proved a serious stock liability. The whole of our effort was concentrated on the building up of our run down labour force, balancing our parts stocks, making and obtaining increased supplies of parts in order to promote output as quickly as possible and so substantially increase Sales by the year end.

Our efforts were rewarded insofar as we cleared all finished goods stocks, balanced and further increased parts stocks, and eventually tapered off output during April, May and June, to finish the year satisfactorily. At the same time we took into the Accounts for the Year the full depreciation of all unbalanced parts stocks and tools of our A130 range of Cookers which had then become obsolete.

During this time we had continued with the tooling up of our new Cooker and as tools were completed, began to build up buffer stocks of parts—a provision largely responsible for the greatly enhanced figure for Stock shown in the Accounts.

Meanwhile, we had experienced certain hold-ups in production and delays in marketing the POWER-MAID Mixer, which in some measure is still in its pioneering and educational stage.

The reduction of Purchase Tax on Gas Fires in March, 1959 began the Sales rejuvenation of our Space Heating Section.

Our Chemical Plant business, unaffected by Credit Control or Purchase Tax, continued its relatively small, but steady profitable activity.

All this, simple to report, was anything but easy in operation, and the greatest praise is due to all who participated in its successful achievement.

The accounts

Referring to the Accounts—the lower figure for Available Funds is explained by the high Stock figure already referred to. The increase in tools value represents only the value in tools in use today.

The POWER-MAID Mixer did not come into production until the last three months of the Financial Year and, therefore, the whole cost of experimental part tooling, establishment of a production organisation and parts stocks, was a relatively heavy charge in the Accounts.

Progress and expenditure on the New Factory extensions referred to in last year's Directors' Report continued, together with other expenditures to finance new and additional equipment. Incidentally, part of the New Factory extension is already in use. The final completion, including new roads, should be effected by the end of the year.

In addition to Capital Commitments as shown on the Balance Sheet, further Orders amounting to £30,000 have been placed since 30th June, being further expenditure for new Buildings, Plant, etc.

I would remind Shareholders that all expenditure in New Buildings, Plant and Machinery, and the continued expansion of your Company, has been financed from earnings. Also worthy of note is that, despite the quite heavy expenditure during the year under review, the actual liquidity position is still favourably comparable with that of the previous year.

To summarise: it has been both an anxious and adventurous year. Though recently there has been a noticeable slackening in the demand for Cookers, I am confident that your Company will be in a better position to meet both competition and reduced demand.

Another major venture

The current year commenced with our Factory Decks cleared for the production of another major venture. The new CANNON Cooker plus the SUPER CHEF Built-in Foldaway Barbecue-Grill, incorporating an electrically driven rotating spit, and recently pilot introduced to the market.

This revolutionary appliance embodies the greatest number of tools and patterns ever used in the production of a British Cooker, and with it all the teething troubles, modifications, alterations, anxieties and headaches, usual to such a project. These have taken July, August and most of September to iron out and while as yet it is a little premature to predict the measure of its success, I can state that it has been market received in a manner which is most encouraging.

Output, though as yet small, is progressively increasing. If it realises the potential sales I personally believe it can achieve, then it will prove another milestone in our development. We are again pioneering a new type of appliance to the housewife—introducing by far the most exciting and delectable way of cooking Meats, Fowl and Game, by old-fashioned Spit Roasting brought up-to-date. It is Simple to Use and Easy to Clean, and in fact, banishes forever that dirty job of oven cleaning as well as objectionable oven cooking smells. Food cooked this way is, of course, far better dietetically than oven roasting.

On matters concerning our Industry and, in particular, Government direction and Controls—your Company's experience over the last three years is surely proof that when State Direction steps in, Prosperity steps out; and when State Direction steps out, Prosperity steps back! The Freedom of decision and resilience of Private Enterprise, can better cope with such set backs so long as it is afforded the opportunity, while still solvent.

The gas industry

What of the position of the State controlled Gas Industry?—Which I support but remain an ardent but well intentioned critic. The recently announced overall loss is in great measure due to

the same factors which have affected your Company.

Technically the Industry has and continues to make most encouraging progress; Commercially it still seeks an answer. Sell or Die applies equally to Nationalised and Private Enterprise Industries. The Nationalised Electricity Industry flourishes mainly because of the dominating Private Enterprise Domestic and Industrial Appliance sales activity which functions outside of its direction and control but with its support to provide an ever-increasing load. Here lies the answer the Gas Industry seek but which they can never hope to implement so long as they continue to maintain a 'closed shop' sales policy.

I conclude on a note of 'How crazy can you get?' Have you noticed that an extensive advertising campaign has been launched on Commercial TV extolling the use of Dirty Air-Polluting coal in open fire grates, which is illegal in many areas. Is this with the blessing of the Ministry of Power? If not, why, in the sacred cause of Smoke Abatement, are manufacturers of solid fuel room and water heating appliances, selling in direct competition with clean heat appliances—subsidised by being Purchase Tax free, while manufacturers of clean fuel appliances are subject to 25% Purchase Tax?

The Ministry of Power has time and again had representations from the Gas Industry regarding this unfair discriminatory subsidy which obviously they or someone, have influenced the Chancellor to maintain. Is it not time the Ministry explained the reason for this extraordinary and unjust position?

The report and accounts were adopted.

Key gas plants tour by Minister of Power

Continuing to get first-hand impressions

FOLLOWING his recent visits to Canvey Island and the Romford reforming plant, the Minister of Power, Mr. Richard Wood, visited the South Eastern Gas Board's new gas-from-oil plant at the Isle of Grain, Kent, on December 11. The plant is close to the British Petroleum Company's Kent oil refinery which supplies oil feedstocks.

The decision to build the new plant, which is the biggest of its kind in the world, was taken as part of the Board's policy to concentrate gas production at a small number of highly efficient works which would be best sited for the receipt of raw materials.

Fully integrated

This new plant is already linked to the Board's South London gas grid and gas production is fully integrated with the Board's other gas-making stations in London. Gas is supplied to the Medway towns and will be fed later southwards to the Sussex coast.

This was the Minister's first official visit to the South Eastern Gas Board's area. He first inspected the plant's central control room where, by means of the latest automation techniques, the entire routine operations of the plant are controlled. There is a teleprinter link with a production control centre at Croydon.

The Minister then saw the first stage of the plant to go into operation, the Segas units. Here oil feedstocks and steam are broken down under high temperatures over a special catalyst to form town gas.

From here Mr. Wood was shown the construction work now in progress for the second and third stages of development which will bring the daily production capacity up to 70-75 mill. cu.ft. of gas. The Shell gasification process will be employed, a notable feature of which is that the gas produced contains so little carbon monoxide as almost to eliminate the risk of gas poisoning.

In the control room at the Isle of Grain works, inspecting one of the automatic operators, left to right, Mr. C. Stott, Chief Engineer, South Eastern Gas Board, Mr. W. K. Hutchison, Chairman, and the Minister.

Accompanying Mr. Wood on the tour were Mr. Hubert Scholes, Private Secretary, and Mr. J. A. Beckett, C.M.G., Under Secretary (Gas Division).

Board officials present were: Mr. W. K. Hutchison, C.B.E., Chairman; Mr. R. H. Sandford Smith, Deputy Chairman; Mr. C. Stott, M.C., Chief Engineer; Mr. J. E. Davis, O.B.E., Chief Technical Officer; Mr. V. W. Stanton, Commercial Manager; Mr. R. G. Huxtable, M.B.E., Secretary, Mr. S. N. Skinner, Station Engineer, Isle of Grain; and Mr. E. R. Ward, Production Engineer.

The Minister's first visit to a gasworks since coming to office was to Willoughby Lane works, Tottenham Division, Eastern Gas Board. Willoughby Lane is a large modern works embodying the best in traditional gas-making practice, and the Minister spent the entire afternoon seeing the continuous and intermittent retort houses and water gas plant at work, and inspecting the coke loading bays and testing centre.

He was told of the Board's production of the high-grade coke Gloco and of its plans for producing Cleanglow.

Mr. Wood was accompanied by Mr. J. H. Dyde, Chairman of the Board, Mr. F. T. Brookes, Deputy Chairman, Mr. E. O. Rose, Chief Engineer, and Mr. L. F. Garner, Works Engineer.

Powell Duffryn acquires Pipeweld Ltd. shares

THE Powell Duffryn Engineering Co. Ltd. has acquired the whole of the share capital of Pipeweld Ltd., a Manchester company.

Pipeweld Limited has for many years undertaken all forms of pipework, including installations at oil refineries and at oil, chemical and gas plants as well as long distance pipe-lines, jacketted and terminal pipework and jetty pipework. Its facilities include complete pipe fabrication, *i.e.*, bends, headers and heat exchangers.

C

25th AUTUMN RESEARCH MEETING

The Vacuum Carbonate and Contact Acid Plants at Beckton

By

L. S. COOPER,
B.Sc.,
FULHAM RESEARCH LABORATORY

and

R. M. JOHNSON,
Assoc.Inst.Gas E.,
BECKTON WORKS, N.T.G.B.

ALTHOUGH there are several plants in the United States of America and in Europe for the removal of hydrogen sulphide by the Koppers vacuum carbonate process, some of which are followed by contact acid plants, the installation at the Beckton works of the North Thames Gas Board is unique in Britain.

At the end of the second world war, early consideration had to be given to the improvement of the purification facilities at Beckton. When considering replacement, bog ore purification plant, in spite of its simple construction and long life, presented problems. High quality bog ore was in short supply, the labour required to undertake the manually arduous and unpleasant work of oxide handling was not easily obtained, and it was becoming increasingly difficult to sell spent oxide.

Hot Actification

The most promising system was the hot actification process, introduced by the Koppers Company at Pittsburg in 1942. This was a development of the same company's Seaboard process; after the gas is washed by a dilute solution of sodium carbonate, the solution is reactivated by steam under vacuum, instead of by air, as in the original Seaboard process. This hot actification process, now known as the Koppers vacuum carbonate process, appeared to be free from the disadvantages associated with the oxidation processes.

It was decided that this type of plant would meet the requirements at Beckton, and the Gas Light and Coke Company decided to erect an installation to operate on 13 mill. cu.ft. per day of coal gas. The plant was designed to reduce the hydrogen sulphide in the gas by 90%, from 480 grains per 100 cu.ft., and the hydrogen cyanide by 85%, from 60 grains per 100 cu.ft. The composition of the recovered hydrogen sulphide gas was expected to be about 70% hydrogen sulphide, 10% hydrogen cyanide and 15% of carbon dioxide. The method of utilisation of this recovered hydrogen sulphide gas required careful consideration. The possibility of using a Claus kiln to produce elemental sulphur was ruled out, as the plant available at that time had a low efficiency. A plant for the production of sulphuric acid from the recovered hydrogen sulphide gas seemed desirable.

Lurgi, in Germany, had been developing the wet contact process in which sulphur trioxide and steam are partly condensed by cooling with sulphuric acid, and the remainder removed from the waste gases by an electro filter. The problem was whether the wet contact plant could satisfactorily deal with gases containing hydrogen cyanide. According to information obtained from Lurgi, hydrogen cyanide could be burnt almost completely to water vapour, carbon dioxide and nitrogen. It was therefore decided to install a plant employing this process, as a complementary unit to the vacuum carbonate plant at Beckton, the design capacity of which was to be for the production of 12.75 tons of 78% sulphuric acid per day. Provision was made for the future installation of the hydrolysis process for the removal of hydrogen cyanide, prior to combustion of the hydrogen sulphide.

The coal gas from the outlet of the wet purification plant containing less than 1.5 grains of ammonia per 100 cu.ft., enters the base of the absorber, at a temperature of 75°F., or less, and it is washed counter-currently with a 5% to 6% sodium carbonate solution, spray distributed, at a rate of about 8,500 gal. per hour. The absorber tower is 72 ft. high and 9 ft. 6 in. diameter and is packed over 44 ft. 4 in. of its height with board packing, $5\frac{3}{4}$ in. by $\frac{1}{4}$ in. boards, with $\frac{1}{2}$ in. spacers.

Completely Lagged

The treated coal gas leaving the absorber passes, via an entrainment separator, to existing oxide purifiers, for hydrogen sulphide removal to be completed. The fouled circulating solution, containing the hydrogen sulphide, hydrogen cyanide, and carbon dioxide, absorbed from the coal gas, is pumped to sprays at the top of the actifier. The actifier is a steel tower 77 ft. 9 in. high and 8 ft. 6 in. diameter, designed to withstand a vacuum of 30 in. Hg.; it is completely lagged on the outside, and the inside is board-packed like the absorber.

During passage down this tower, the absorbed hydrogen sulphide gases are removed from the foul solution by

Abstract and discussion of a paper presented to the Institution of Gas Engineers in November.

counter-current stripping with steam, under high vacuum conditions. The hot actified solution is pumped from the base of the actifier, via three coolers in series, to the sprays at the top of the absorber, for recycling. The solution coolers are water tube in shell type, designed to cool the solution to about 75°F. The hydrogen sulphide gases, together with stripping vapour, pass from the actifier via an entrainment separator, through a vapour condenser, vapour cooler and a knockdown tank, before entering the vacuum pump. Leaving the vacuum pump, it passes through a catch tank and thence to the acid plant where it is fed to the combustion chamber.

The cooled gases enter the converter at the top, pass downwards through four trays of vanadium catalyst, and out to the condensation tower. In the converter, sulphur dioxide is oxidised to sulphur trioxide. In the condensation tower, circulated, cooled sulphuric acid condenses and absorbs most of the sulphur trioxide and water vapour.

The remaining sulphur trioxide, now at a temperature not more than 50°C and in the form of an acid mist, passes to a lead-lined electrostatic demister, for complete recovery; the exit gases go to atmosphere via a lead-lined stack.

The early working of the vacuum carbonate plant was mainly in the nature of getting to know the plant and to establish routine working procedure. Around 85% efficiency of hydrogen sulphide extraction at the absorber was consideretd satisfactory at that time. Later, when more particular attention was paid to extraction efficiency, it was determined that plant performance was closely related to the effectiveness of the coolers, particularly the vapour coolers. The presence of rust deposits in these coolers is partly responsible for their deficiencies, but it has been found that, even with freshly cleaned units, the design conditions were only obtained because the amount of cooling water available was greatly in excess of that specified. It is considered that the 90% design extraction efficiency could be obtained, even with capacity loading, if a reasonable period could be worked with the desirable gas temperature at the inlet to the vacuum pump.

Although a small loss in extraction efficiency makes little practical difference to the final purification of the stripped coal gas, the loss of acid production is of economic importance. A drop of 5% in extraction efficiency at full load, results in a loss of over 13 cwt of 140°Tw. acid per day. A more important economic aspect is the production loss suffered when the vapour coolers are being cleaned. Additional cooling capacity is obviously required.

Further Improvement

Blockages by polymer in the hydrogen sulphide gas services to the acid plant burner, also proved to be related to the temperature at the inlet vacuum pump, have been already reduced. It is anticipated that still further improvement could be obtained by the provision of an entrainment separator immediately after the catch tanks and the installation of a water-cooled flame trap to replace the existing crimped metal type.

A little difficulty has been experienced in the control of the converter inlet temperature by damper regulation at the radiation cooler; load factor and, at times, weather conditions have indicated limitations in the range of control possible. The available coal gas load has only allowed a very short working period for the complete installation. Operation of both units has been found to be relatively straightforward, and the attendants have settled down to a satisfactory standard of routine supervision.

The acid plant, in spite of one undesirable long suspension of operation and fairly numerous short stoppages occasioned by outside circumstances, has proved to be a very efficient unit, and the 98.5% conversion that is still maintained is very gratifying. Tests showed that the hydrogen sulphide load at the absorber varies by up to 25% in a 2-hour cycle, but the vacuum carbonate plant has a smoothing effect so that fluctuations in the hydrogen sulphide supply to the acid plant are reduced to around 10%. Experience has proved that the acid plant is, without adjustment, flexible enough to handle this fluctuation.

Without including capital charges, it is possible to estimate the cost of acid production at Beckton. The operating costs on the vacuum carbonate and contact acid plants have proved particularly advantageous and compare favourably with the operating costs on the old oxide plant, which the new plant at Beckton replaced. A value of £7 10s. per ton for 140°Tw acid is a reasonable value for the acid produced, but the market is a variable one. No attempt has been made to include capital charges in this comparison, as the size of installation at Beckton is not necessarily the optimum, and information is still needed on the 'life' of the plant.

DISCUSSION

Mr. H. Bradley, North Thames Gas Board: There has been for many years a search for a process of removing hydrogen sulphide from gas which would have all the good features of the iron oxide process and none of the bad ones. Much emphasis has been placed on liquid purification and several processes have been developed to the working scale, but none has so far displaced the conventional iron oxide method. This has been due to various causes, among which have been the use of toxic solutions, the production of unsatisfactory products and the presence of undesirable effluents. The authors do not claim that a satisfactory replacement of the oxide process has been developed, but they show that the vacuum carbonate and contact acid plants together enable us to remove hydrogen sulphide and hydrogen cyanide with no serious operational difficulties and with a reasonable possibility of covering the running costs. The product is sulphuric acid, which is quite saleable, as compared with spent oxide. The main raw material used in the process is soda ash which may be said to be in unlimited supply, whereas reserves of the requisite iron oxide in countries near the British Isles are finite, although sufficient for some years yet.

The authors draw attention to the main difficulty, which is that the vacuum carbonate process of extraction is incomplete and therefore the conventional method is necessary for the removal of some 10% of the hydrogen sulphide. It does not seem possible to eliminate this, as it is inherent in the process, which is based on a reversible chemical change, as the authors show. In fact I think that considerable credit is due to the chemical engineers who designed the vacuum carbonate process, as the basis of the design is a chemical reaction which is incomplete, and would indeed be less complete were time given for the establishment of the reaction in the reverse direction with carbon dioxide. The balancing of these two factors is a sound piece of chemical engineering.

The authors rightly describe the difficulties which have been encountered in the operation of the plant. They have been relatively small and certainly less than we imagined when the introduction of a plan so unusual to most of our operational staff was considered. The leakage of hydrogen sulphide was the first problem, and we were helped in this by being forewarned in conversation with the staff of a similar plant at Ijmuiden in Holland. The precautions which we have taken and which are described in the paper seem to be quite adequate.

The second difficulty is connected with the occurrence and deposition of polymers, but we are confident that this will give us less and less trouble as simple modifications

are made to prevent deposition in vital spots. The difficulties have not been greater than might be expected in starting up a new plant. The acid plant section has worked extremely well in spite of the presence of hydrogen cyanide in the gas to the burners. There has been no difficulty whatever in maintaining the composition of the entry gases well within the statutory limits in respect of nitrogen oxides.

The attendants for the plant were drawn in the normal way from our purification department labour strength and after training in the operation of the plant, including the carrying out of simple chemical tests, have proved themselves capable of operating the plant quite satisfactorily. A tribute is due to all who have been concerned with the project—and the authors have given, I think, an admirable summary of the combined endeavours and accomplishments. I should like to say something which may sound strange coming from me, to many of the contractors, namely, that we at Beckton were chiefly responsible for the slow progress of the project, and our thanks are due to them for their co-operation throughout.

Mr. G. U. Hopton, North Thames Gas Board: The reasons which led us in 1948 to pay so much attention to liquid methods for the removal of hydrogen sulphides are given in this paper. But, of course, things have changed since then. High quality bog ore has become more readily available with the opening of the Danish resources and some efficient purification material of an artificial kind is also readily obtainable, so that we need not have feared so much for our supplies of iron oxide; and with regard to the labour problem in dealing with boxes, we now have tower boxes with mechanical tipping of the oxide from the trays combined with the practice of crushing and returning the oxide immediately to avoid the labour of handling the oxide on the floor. We no longer face serious labour difficulties in oxide purification, but one difficulty remains and is more serious now than ever before. We face a glut of sulphur with the working of the natural gas deposits, and spent oxide becomes increasingly difficult to get rid of.

Removing Hydrogen Cyanide

Dr. Barnes, Mr. Townend and I studied the vacuum carbonate process in the U.S.A. in 1948, over 11 years ago. We came to the conclusion that the process was sound in theory and practice, but there was some doubt about the behaviour of hydrogen cyanide in the treatment of hydrogen sulphide gases. Accordingly, the Fulham research laboratory studied methods for removing hydrogen cyanide from hydrogen sulphide and evolved a process depending on the reaction of hydrogen cyanide with steam over activated alumina at 290°C. This forms ammonia, which can readily be removed from the gas. The work has been described by Marchant, Cooling and Rich, of the staff of the laboratory. The process was tried out in a pilot plant on a scale of 1,000 cu. ft. per hour, from November 1951 to February 1952 and was completely satisfactory. In the meantime, however, we studied plans in the Ruhr running on gases containing hydrogen cyanide and discussed the behaviour of such gases in a Lurgi wet contact plant. We came to the conclusion that the hydrogen cyanide would be adequately destroyed in an expansion of the combustion chamber partly filled with checker brickwork and operated at 1,100°. The decision was made to go ahead on these lines with a contact acid plant, because its conversion efficiency would be higher than that of the kiln, and to keep this other process in reserve in case we did not do so well as we hoped.

You have heard the reasons for the delay. We received tenders and specifications in June, 1952; the vacuum carbonate plant went to work in 1957 and acid contact plant in 1958. I think it will be agreed that the results given in this paper justify the installation of these plants. The gas making conditions at Beckton have changed so much and the plants have worked for a very short time, but they have proved completely satisfactory. I think we shall find that the operating costs are so much less than those for oxide alone that they will more than cover the additional capital charges.

I should like to suggest that for future liquid purification plant of the desorption type, we might consider passing the hydrogen sulphide gases to the Claus kiln. This would give us another choice. The modern Claus kilns, unlike those which we inspected in 1951, carry out the reaction between hydrogen sulphide and sulphur dioxide in more than one stage. Its efficiency at 92% when employing a waste heat boiler with one reactor and 97% for a waste heat boiler with two reactors and inter-stage sulphur condensers, is very high. The residual hydrogen sulphide can be oxidised readily to sulphur dioxide to satisfy the alkali inspector and we have found very good after-oxidation catalysts at the Fulham research laboratory.

One might think that the economic size of a Claus kiln was smaller than that of a contact acid plant; perhaps it is easier to handle and store the sulphur, and this by-product sulphur is of high quality, but we must be sure that we can deal with the hydrogen cyanide, which must be destroyed and the ammonia formed during the combustion absorbed. This can be done by pre-mixing the gases with just sufficient air to oxidise the hydrogen sulphide to sulphur, maintaining the combustion temperature above 800°C.—this is not a great strain on any refractory—and then passing the gases through a non-siliceous catalyst. That may be an attractive alternative to that described by the present authors.

Mr. J. Maloy, Woodall-Duckham Construction Co. Ltd.: It will be seen that the H_2S absorbing section of the plant was put to work about a year before the acid plant. This was a boon since it enabled us to carry out a thorough investigation of the unit. As the process was a new one to Britain the kindness of the North Thames Gas Board in allowing us to extract H_2S from gas and then immediately put it back again was invaluable. The ready co-operation and willing help of the North Thames Gas Board enabled the teething troubles to be overcome and also ensured that the conditions would be safe before continuous operation was started.

Adequate System

The pumps and instrument panel at Beckton are housed within a building, but experience has shown that these would be better situated under a lean-to roof open on three sides for free access and cheaper ventilation. The ventilating system finally adopted nevertheless proved adequate.

Reference is made in the paper to the knock-down tank which follows the vapour coolers as serving simply as a catch tank. It has also a very important duty to serve as it is fitted with an alarm system. For example, if the foul solution pump fails, the boil-over from the actifier will increase due to the lack of foul solution coolant. The subsequent overloading of the vapour coolers commences to fill the knock-down tank and when a predetermined level is reached an alarm is sounded. If no correction is made by the operator and the level builds up further, the vacuum pump is automatically stopped thus ensuring safe conditions.

One point of interest not mentioned in the paper is that when the whole unit is put out of operation the apparatus is arranged to be opened up to a permanent coal gas purge system and kept under pressure to prevent the ingress of air.

In [Table 4] there is an item of £10 17s. per day for low-pressure steam, which is approximately 18% of the running costs of the vacuum carbonate plant. This heat, however,

could be obtained instead from the flushing liquor or from the gas stream before it enters the primary coolers. In such cases auxiliary heat exchangers for the foul solution are provided. Certain plants abroad satisfactorily employ this system which costs nothing so far as the heat requirements go and in fact reduces the heat load on the primary coolers.

Referring again to [Table 4], it will be seen that the shift labour costs appear to be equivalent to half a man per shift for the vacuum carbonate plant and one man per shift for the acid plant. Since the vacuum carbonate plant is completely automatic, however, it would seem that the two sections could be so arranged as to permit the supervision to be reduced to a total of one man per shift. I should like to have the authors' comments on this suggestion.

Gratifying Combination

The combination of a vacuum carbonate plant and a contact acid plant for the combustion of the H_2S and HCN gases has proved most successful. The original hopes that by careful control of the acid plant temperatures the HCN could be satisfactorily converted into harmless products, CO_2 and nitrogen, have been fulfilled. It is also gratifying to note that the combination of the two plants has proved capable of dealing with a constantly fluctuating gas flow and a variation of about 25% in the H_2S load.

Mr. G. Dougill, North Thames Gas Board: One of the problems with this type of plant is that it is necessary to sell sulphuric acid at the rate at which it is made, and that rate is controlled by the gas load. If it is possible to find a customer who is willing to take acid in large quantities in winter, when the plant is heavily loaded, and very little in summer, when the plant is lightly loaded, well and good, but there is a real problem here. The way in which it is obviated in America is that the acid plant is made larger than the vacuum carbonate plant and the shortage of sulphur dioxide is made up by a very cheap sulphur plant burning rock sulphur. When the gas-making plant output is reduced, the extra sulphur dioxide is readily obtained from the sulphur plant and the requisite quantity of acid is available for sale. This method was known to the contractors and was pointed out by them. It would be a very useful method of improving this plant, particularly should such a plant be situated in a place where sulphuric acid was not so readily saleable and where, therefore, fixed contracts for long-term delivery would have to be made.

Mr. H. G. Markward, Huntington, Heberlein & Co. Ltd.: First of all, it may perhaps be interesting briefly to explain the principal difference between the wet contact process and the orthodox contact process. In the straightforward contact plant either the combustion air or the SO_2 gases are dried before they enter the convertor and the SO_2 formed in the converter is absorbed in 98% acid. In the wet contact plant H_2S and O_2 form SO_2 and water. This mixture, the water content of which depends on the moisture content of the H_2S-containing gases and of the combustion air and also on the HCN content, enters the converter without drying and thus theoretically the maximum available H_2SO_4 concentration is bound to be well below 95%. For this reason the condensation equipment and the precipitator described in the paper are used instead of an absorption plant. In order to keep maintenance costs at a minimum, 78% acid is produced and this concentration is kept constant by the addition of an adjustable amount of water.

As already mentioned in the paper, the presence of HCN as an impurity in the H_2S gas at fairly high concentrations was one of the most important items to be considered when the plant was designed. There was very little experience available in this respect and it was particularly feared that compounds of nitrogen might adversely affect the acidity of the exit gases. As pointed out in the paper, the nitrogen oxides in the exit gas have not exceeded .06 grains per cu.ft. expressed as SO_3. Combined with the high efficiency of the converter and mist precipitator the result is an invisible exit gas with a total acidity, so far as I am aware, always well below 1 grain per cu.ft., again expressed as SO_3. I think this point is particularly interesting as there was also some apprehension about the effect of the fluctuations in volume and composition of the H_2S-containing gases unavoidably caused by the operating conditions of the retort houses. The vacuum carbonate plant acts in a useful way as a buffer; nevertheless, quite noticeable fluctuations still take place at the inlet of the combustion chamber. As will be seen from the paper, no ill effects were noticed on that account.

The cost of the shift labour for the contact plant given in [Table 4] amounts to one man per shift. If additional duties for this man could have been found adjacent to the contact plant it would have been possible to reduce this cost, perhaps in the way suggested by Mr. Maloy.

As will be appreciated from the paper, some time has elapsed since the plant was designed. Although the paper does not refer to capital cost, I may perhaps say that, based on experience gained in rather more than 50 wet contact plants, a similar plant would today be still more compact and consequently cost less. For instance, as mentioned in the paper, a simpler combustion chamber could be used, even for gases fluctuating to some extent in volume and composition and containing rather large quantities of HCN. There is now no practical reason why the converters should not be built of any required size. The most interesting development, so far as capital cost is concerned, is, I believe, the introduction of what we call a ceramic mist filter as an alternative to the electrostatic precipitator. This unit is extremely small and the capital and maintenance costs are very low. It comprises a number of ceramic filter tubes or candles of controlled porosity through which the gases pass from the inside to the outside of the ceramic material so that the mist particles coagulate and liquid acid runs down the outside of the filter tubes to the base of the filter casing. A number of plants using this equipment are in operation.

Welded Structure Fatigue

THE British Welding Research Association and the engineering department, Cambridge University, are jointly organising a symposium on Fatigue on Welded Structures. This is to be held in the engineering department, Cambridge University from March 29 until April 1, 1960. A full discussion of the subject of fatigue of welded structures is thought to be of considerable importance at the present time.

A good deal of research has now been done, but the expansion of welded fabrication in many areas where fatigue strength is a criterion is revealing new aspects of the problem. Present knowledge might therefore be usefully consolidated and new aspects considered by those people who are directly concerned with and interested in the investigation of the fatigue of welded structures.

Several papers will be presented by experts and will include contributions from the United States of America and from East Germany. These will deal primarily with structures fabricated by fusion welding processes. The fee for membership of the symposium is 15 guineas. Further particulars may be obtained from the British Welding Research Association, Abington Hall, Abington, Cambs.

25th AUTUMN RESEARCH MEETING

Gas in Industry—Some Relevant Investigations

By

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THE principal factors likely to encourage a growth in the use of gas by industry are twofold:

(*a*) The Clean Air Act. Gas provides the complete answer to problems of pollution, and is to be preferred to oil, which releases large amounts of sulphur oxides into the atmosphere, conventional methods of electricity generation, and to nuclear power, which brings its own still largely unexplored risks of pollution.

(*b*) Gas-burning requires simpler equipment than does oil-burning. No tanks, pumps or heaters are required, and the installation and maintenance costs are correspondingly less. It is the ideal fuel for automatic control and precise regulation.

In particular, there is the well-known advantage of furnace atmosphere control, which leads to the use of gas in a number of special metallurgical furnaces at the present day. However, it is not beyond the limits of possibility that clean, high-calorific value gas may one day compete for the firing of such furnaces as the open-hearth or glass tank, where it would be used perhaps in conjunction with a suitable illuminant. The accumulated experience of the gas industry in the production of a fuel of uniform quality from a variety of raw materials constitutes a form of guarantee for a prospective user against interruption of supply.

A number of problems related to the efficient use of fuels for industrial heating are being studied at research establishments in several countries. Probably, one of the most intensive investigations is that being carried out by the International Flame Research Foundation at Ijmuiden, Holland, whose work includes some measurements on the combustion of and heat transfer from gas flames.

Increasing Luminosity

The tests on gaseous fuels have been carried out in a furnace about 21 ft. long and roughly 6.6 ft. square in cross-section. The average furnace load is about 10 to 14,000 cu.ft. of gas per hour, equivalent to a heat release with the fuels tested of 5 to 8 mill. B.t.u. per hour. The trials on gaseous fuels have been mainly concerned with increasing luminosity by increasing the carbon to hydrogen ratio. Means of increasing luminosity by pre-heat, pre-combustion and very slow mixing, while they have been discussed, have not been tested. It has been shown that the radiation increased proportionally to the quantity of fuel oil added to coke oven gas flames. Up to 15% of fuel oil was used. In the next two trials, it was possible to replace about 20% of a heavy fuel or about 30% of pitch creosote by coke oven gas without appreciably reducing the emissivity of the resultant flame.

The only indication as to what these changes in radiation mean to the overall heat transferred from the flame which is available from these trials comes from observations of the re-radiation from the walls, which is, of course, a function of wall temperature. This shows a relatively small change; e.g., while the peak radiation from the flame increased from under 5 cal. per sq. cm. second to 12½ cal. per sq. cm. second (an increase of 150%) when changing from a coke oven gas to a heavy fuel oil flame, the maximum difference in wall radiation was never more than about 1 cal. per sq. cm. second over the whole length of the furnace, equivalent to 17% of the wall radiation at the same position as that at which the maximum flame radiation occurred.

Two Factors

Many workers, including those in the B.C.U.R.A., consider that there is a degree of interdependence between flame temperature and emissivity in any set of flames characterised by a given heat input per unit gas volume, by which a reduction in emissivity is compensated for by higher temperature, and *vice versa*. The net result may be that there is little change in the thermal flux representing radiant heat transfer from the flame to the heat sink. It follows from this line of argument that there are two factors that can influence the rate of heat transfer by radiation. The first is the rate at which heat is released in the flame, which is dependent on the rate of combustion per unit of heat-receiving surface. The second is the rate at which heat is transferred from flame to charge—the thermal flux; this will depend (for any given surroundings)

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on the heat released per unit volume of waste gases, which governs the theoretical flame temperature.

The rate of combustion of gas in a diffusion flame is very rapid compared with the rate of mixing of fuel and air and there is no doubt that measurements of mixing, using model techniques, can give much information about the effect of burner and furnace design on the performance of a gas-fired furnace using flames of this type. In this connexion, some experiments carried out in the B.C.U.R.A. during a study of the ways and difficulties of simulating conditions in an industrial furnace, using a small isothermal model, are of interest. In this work, the combustion in a small gas-fired furnace was compared with the flow pattern in a cold model of similar overall dimensions.

Most of the regenerative open-hearth steel furnaces and glass tanks in Europe were fired, until recent years, by producer gas or by mixed coke oven and blast furnace gas; in America, natural gas, which possesses the advantages of uniform composition, easy controllability and freedom from sulphur, was used in places. With the growth of Middle East oil supplies, and the accompanying fall in the price of fuel oil relative to that of coal, there has been an increasing tendency on the part of steel manufacturers, and to a lesser extent on the part of the glass manufacturers, to turn to oil-firing.

Some gaseous fuels, notably coke oven gas, burn in the open-hearth furnace with non-luminous flames and there is a marked reluctance on the part of the furnace operators to use coke oven gas alone for steel-making. This may be due in part to the difficulties of preventing impingement and overheating with a flame one cannot see. As mentioned previously, natural gas, which is mainly methane, has been used quite frequently for steel-making in America, but no comparison with other methods of firing is available. More recently, an Italian glass furnace has been fired with natural gas, and it has been stated that it gives efficient heat transfer, uniform temperature distribution, minimum wear of refractories, ease of modification and control of combustion and of furnace atmosphere, and little formation of scum.

On its own, town gas made by any of the normal processes does not give a highly luminous diffusion flame when compared with, for example, fuel oil or producer gas.

DISCUSSION

Professor R. J. Sargeant: It has been my responsibility to sit as the Chairman of a Committtee which is attempting research—and, I think, doing it very successfully—into the use of producer gas and to try to fight the battle against oil. One would, of course, say 'Well, it is almost impossible'; but I do not believe that is so. I have believed for many years that the thermal flux above the level of the heat sink is the factor that determines the efficiency of heat in a furnace chamber.

I think it was shown many years ago by Sherman that luminosity in a town's gas flame was not so very important when one got down to the designing of a furnace and making it work to do a particular job; and this work which B.C.U.R.A. is now putting out is something that I can feel is fitting in very well with the experience that I myself have had over quite a number of years and in quite a number of different industries in which I have attempted to find out what are the factors that one uses in designing a furnace.

One can, of course, work out all the heat transfer coefficients according to the known laws, but when one gets into the chamber where one has a complicated process going on—flame patterns, turbulence, chemical reactions, temperature changes, buoyancy factors and so on—one's task in trying to calculate anything becomes almost impossible.

Therefore, my own attempt has been to try to correlate all the factors that I can measure and see how they tie up. It started with a study of certain types of furnace that were used in the non-ferrous industry—muffle furnaces. A whole range of tests were done, and there seemed to be no explanation for what had been happening. It was quite simple when one tumbled on the relationship with the efficiency, or one could take the relationship of the number of B.t.u. that go into the charge related to the area of the muffle plotted against the efficiency of the furnace, and that gave a straight-line relationship for a whole lot of furnaces of all different sizes.

Again, with re-heat furnaces, open hearth furnaces, you find that you make your correlations and try to tie them up with the dimensional factors, and you find that there are some basic relationships which are extremely valuable in furnace design.

We plotted the same dimensional relationships, taking the number of B.t.u. that went into the ingot related to the heat surface and relating that to the efficiency. As the load goes up you get a straight line between the efficiency and the load. You can overload; you can get the optimum efficiency, and then your efficiency drops.

However, in all those experiments, covering hundreds of observations on practical plants, in which all sorts of fuels were used, one could never find out that one particular fuel really differed more than perhaps ±5% from any other.

Technical Energy Lacking

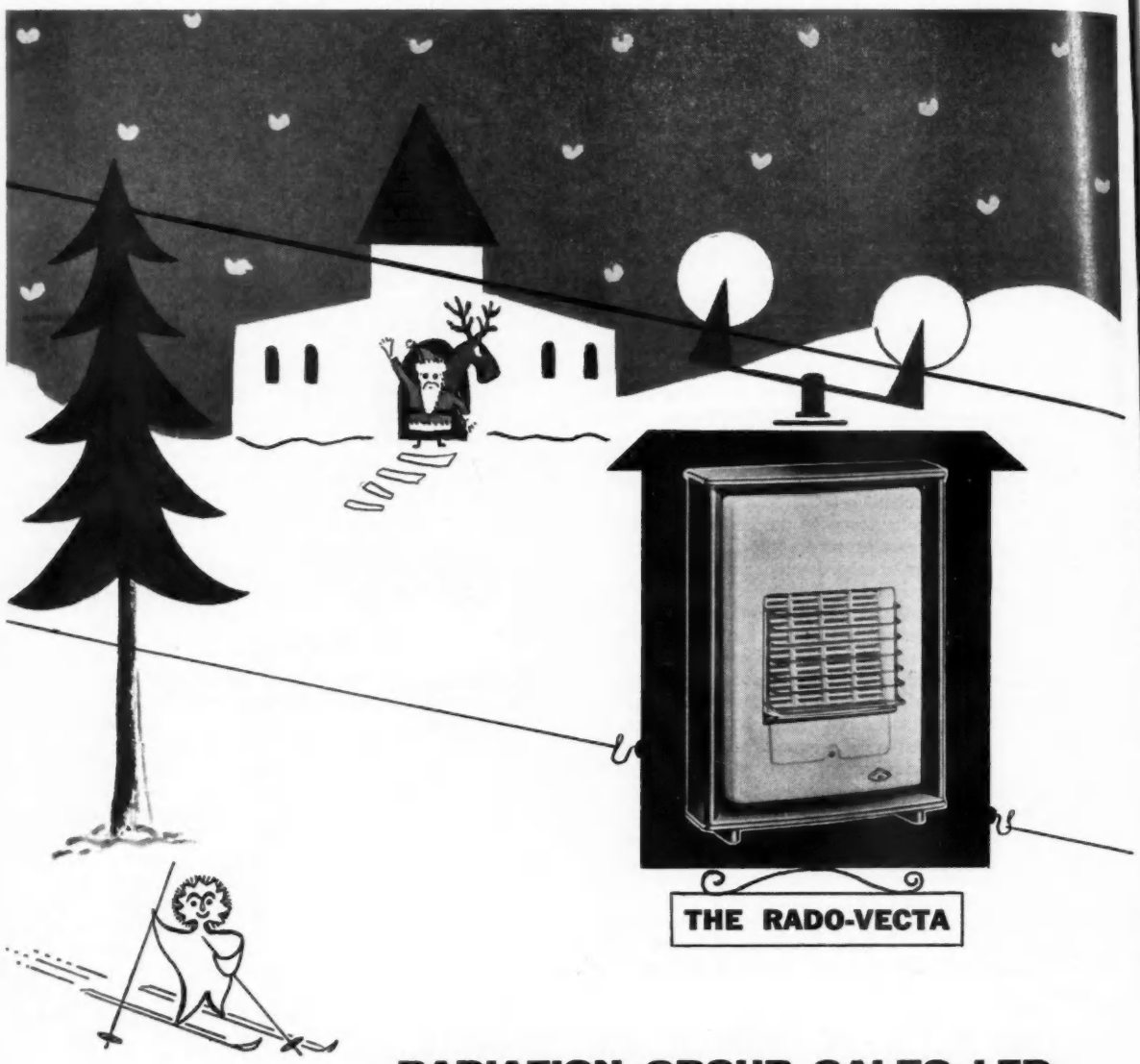
So I say that it is a question of the thermal flux. It does not matter what the composition of the gas is if you can get the thermal flux there. If you use a gas of high calorific density or oil, you can drive it hard and get more out of it. That is why the steel industry went over to oil; they were able to put up their output. However, I say that if they had paid attention to and put the technical energy and drive into the development of gas producers or any other form of gas-making appliance, oil would not have been used. Of course, it was a national necessity at the time.

So I feel that here is a most important matter to which the gas industry should pay attention. When I talk to engineers I put it to them 'We must have total gasification. We should save the coalfields. It is ridiculous to be relying on imported fuels.'

In this case, I think there is something to be said for using other fuels than oil, and you can do just as well in the furnace. Those engineers to whom I alluded have said 'If you can give us a distributed clean gas, we do not want anything else. You can put the furnaces on the roof.' I say that you can increase your overall thermal efficiency three times. The average efficiency of furnaces in certain industries is only of the order of a few per cent., perhaps 5%, and it is a poor thing if you cannot bring it up to 15%.

I feel that attention must be paid to the problem of 'How do you make producer gas do the job?' 'How do you make town gas do the job?' or 'How do you make any gas that you are going to produce do the job?' So far as industrial practice is concerned, it does not matter what gas it is as long as you give the gas in such a form that it is consistent in quality and the price per therm is a competitive price. Then there is every possibility that the future should be total gasification. We should still be thinking of using our coalfields, and, technically, so far as the use of the fuel is concerned, I see no difficulty.

Mr. R. F. Hayman, Gas Council: The authors mention work carried out by the International Flame Research Foundation at Ijmuiden and state that little direct work on gas firing is contemplated in the near future. I would say that no work is contemplated in the near future. The trials which are planned will be concerned with oil or pulverised fuel, certainly for the next year or so.



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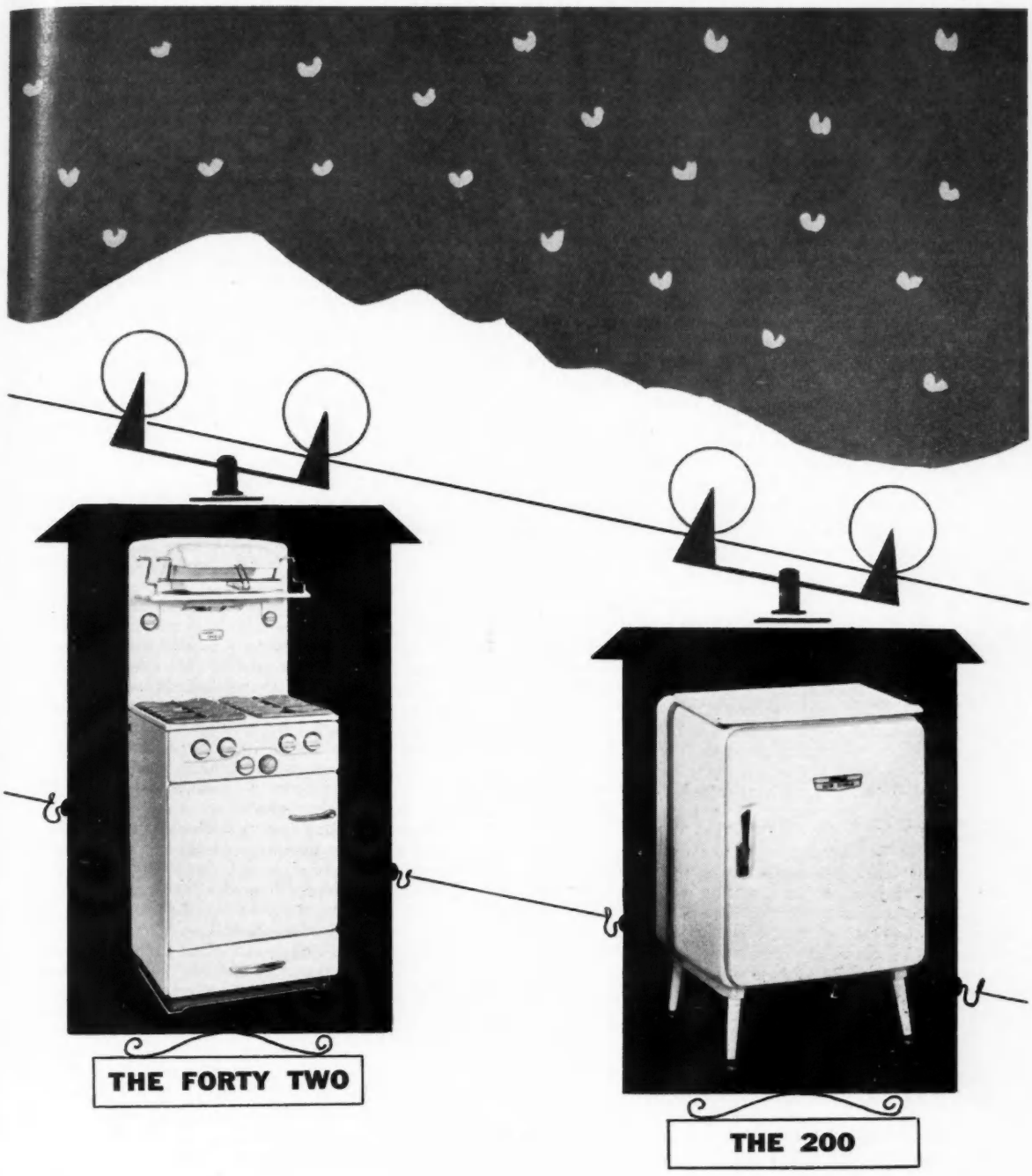

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There is, of course, some justification for this, but the gas industry is a subscriber to the Foundation, and at the moment it must make the most use of the available information which, of course, is of permanent fundamental value to the users of all fuels. I should like to see more interest being taken in Ijmuiden by users and makers, perhaps in the form of visits. Certainly, much more study must be paid to the detailed investigation of the published results of work to date. If we are to get any valuable working results out of the fundamental work which has been done, this is what must happen. There is already in existence a lot of information which will enable equipment to be designed on a rather better basis than before.

The work at Ijmuiden has suggested that an increase in emissivity of a flame does not necessarily result in a proportionate increase in heat transfer. Here I should like to embellish Professor Sargeant's remarks, because the discussion of melting furnaces by the authors on [p. 26] makes me wonder whether too much attention is paid to high emissivity, or the value of it, and not enough to the value of forced convection, particularly at high temperatures. Mr. Ward in his paper reporting on his Dempster Fellowship remarks on the interest in Germany in gas/oil burners for steel melting. There appears to be a feeling on the Continent that oil is necessary for the maintenance and development of high temperatures, but when one melts steel at about 1,600°C. there can be little advantage at that temperature in a high emissivity flame to affect heat transfer, and much of the work could well be done, and probably is done, by forced convection, and, certainly, more work is needed on this tricky subject.

I would say that for the future, whatever national problems present themselves, oil may well have to be used for steel melting, but there could be a great future for gas in refining and holding steel temperatures.

Mr. E. Thornton, North Thames Gas Board: First, I am going to refer to the curves given in [Fig. 17, on p. 31]. The curves numbered 1, 2 and 3 show how, for the same flow rate, the efficiency of heat transfer from a hot gas to the tube wall increases as the diameter of the tube is reduced.

Some of you will remember that at the Autumn Research Meeting last year there was a paper on immersion tube heating. In this paper an equation was given relating the efficiency of heat transfer through the tube walls to the length and diameter of the tube. This equation indicated that the efficiency would increase as the tube diameter decreased, but at the time there were not sufficient laboratory results to confirm this. [Fig. 17] shows that this prediction is correct qualitatively.

Satisfactory Equipment

From the values given in [Fig. 17], the increase in efficiency resulting from a change in tube diameter from 2¾ in. to 1½ in. is in the range 6 to 9 units %. The calculated values, based on the immersion tube equation, give an increase of between 5 and 6 units % for the same change in diameter.

Bearing in mind the differences between the two systems being compared, namely the presence of a flame in the immersion tubes, and the differences in temperatures, this represents quite satisfactory quantitative agreement.

It is encouraging for us to find that our results agree with those of other workers, and it shows the value of collating as much as possible of the relevant scientific literature, and keeping closely in touch with other workers in related fields.

The second point I wish to raise is in connection with temperature measurement. The authors have rightly pointed out the small scale of many gas-fired appliances, and the need we have for small instruments.

At Watson House we are investigating natural draught combustion chambers. For this work we require very small temperature measuring instruments which will give the correct temperatures without appreciably altering conditions in the system. This requirement limits both the size of the instrument and the suction rate permitted. We have in mind a probe up to about ¼ in. external diameter, and a suction rate of about 1 cu.ft. per hour.

I would be grateful if the authors could tell us if they think it feasible to scale down the venturi pneumatic pyrometer to such a size, or to indicate what are the lowest limits of size practicable.

Dr. D. Hebden, Midlands Research Station: I propose to confine my remarks to that section of the Paper dealing with gas manufacture. At Solihull the Gas Council are in the process of developing a high pressure gasifier for operation on coal under slagging conditions of 300 p.s.i. This work is being carried out in collaboration with the Ministry of Power and naturally close contact is maintained with the parallel investigations being undertaken for the Ministry by the B.C.U.R.A.

While apppreciating that this paper is essentially a review of the wide variety of work being done by the Association and does not set out to elaborate on particular features of the various investigations, there are one or two points I would like to raise in a little more detail.

Increasing Ash Content

First, it is perhaps rather misleading to say that the removal of 'ash as slag . . . involves an appreciable heat loss'. The effect of increasing ash content is not to increase the sensible heat loss as is inferred, but rather to redistribute it. That is to say, as the ash content of the fuel supplied to a slagging gasifier increases, sensible heat is removed in the slag, not at the expense of potential heat, but at the expense of sensible heat leaving the gasification zone in the product gases, or in other words, the effect is to depress the temperature of the exit gases. It follows, therefore, that if one is concerned about recovering the heat leaving in the slag from a high ash fuel, one should be equally concerned about recovering the heat leaving in the product gases from a low ash fuel.

This question of the influence of ash and less directly moisture also, on the distribution of sensible heat is of paramount importance in considering the gasification of coal under slagging conditions. With a high ash coal so much heat can be diverted away from the distillation zone that the gases leave the gasifier at an insufficiently high temperature to carry with them the higher tar fractions. This state of affairs will lead to increased difficulties associated with the agglomeration of the coal at the top of the fuel bed and needs to be counteracted or controlled by making more heat available to the distillation zone. This can be done in a number of ways, and one of them is, of course, to inject part of the fuel as dust direct into the reaction zone through the tuyeres. Since we are interested in fuel injection as a method of controlling conditions in the distillation zone and of utilising fines it will be appreciated that the work being done by B.C.U.R.A. will be of great value to us and we are following their development of the technique with interest.

In increasing the amount of sensible heat available in the distillation zone, and hence the temperature of the exit gases, the injection of fuel at the tuyeres inevitably leads to an increase in oxygen consumption. It is, therefore, desirable that the charge against the fuel injected at the tuyeres and/or the cost of the fuel supplied to the fixed bed should be low enough to save the cost of the extra oxygen. In this respect the slagging gasifier with enrichment of the gas by coal hydrogenation may prove an interesting combination. The highly reactive and ready

preheated residue which would be available under pressure from the hydrogenation stage should make an ideal fuel for injection.

Mr. E. H. Hubbard, British Petroleum Co. Ltd.: There is one particular aspect of the results of the radiation measurements which the authors have made in their evaluator furnace should be brought to the fore and in this connection I must take the liberty of crossing swords with Professor Sargeant.

If you make a flame in a box and change the fuel and keep the calorific input of the fuel constant, the chances are that you will arrive at the same amount of heat transfer in the box, particularly if you project your flame down the centre of the box. If you did not do that, it would mean that the efficiency of the box as an absorber of heat was being changed.

What we have to remember are the fundamental principles of heat transfer, by radiation and by convection. In the case of radiation, one has the heat transfer, which is a question of the emissivity of the flame multiplied by the fourth power of the absolute temperature. So we can either change the emissivity of the flame or change the absolute temperature if we want to alter our heat transfer. It so happens that anything that we do normally to increase the emissivity of the flame lowers the temperature.

If we consider a non-luminous flame, such as a gas flame, and compare it with a luminous flame, such as a flame from a liquid fuel, burn them in the same furnace, give them the same calorific input and have cold combustion air—I want to talk later about hot combustion air—and no oxygen, it so happens, due to the complicated processes of heat transfer which Professor Sargeant mentioned between the walls of the furnace and one part of the flame and the next, that the temperature of the gas flame will be anything up to 200° or 250° hotter than the temperature of the luminous flame, although if you stand there with an instrument and measure the radiation from the two flames you will get more from the luminous one.

The point that I wish to emphasise is that when you measure radiation from a flame with a cold instrument—I mentioned this last year when we were discussing Mr. Patrick's paper on inefficiency—it has only a limited use; that is, the figure which you get from your instrument, and the limited use arises from whether the receiving surface of your work is like the instrument with which you are measuring—that is, cold. Therefore, you can apply these results in a boiler but not in a glass tank or steel furnace or cement kiln. The kiln itself may be 1,500°C. Also, as we have heard mentioned, steel melts at 1,600°C., and so you cannot expect to get any use from steel until it is at that temperature.

Temperature Difference

If you go back to the fundamental text books on heat transfer, without doing any experiments at all, you can plot a curve of the heat transfer from a flame to a body of different temperatures. If you take a luminous flame with an emissivity of .8 and a temperature of 1,500°C., you can plot the heat transfer to bodies at whatever temperature you choose. If you take the non-luminous flame emissivity at about .3, and it will have a temperature of nearly 1,700°C., you can plot a curve of heat transfer from that flame to various receiving surfaces. You will find that the two curves cross, and they cross at about 1,350°C., which means that at that temperature it does not matter which fuel you use. Without going any further, it is obvious that once you are above 1,500°C. the luminous flame is no good to you unless you can raise its temperature.

My point is that while we are dealing with heat transfer to things which themselves are hot, it is the temperature difference which is important for convection and for radiation. However, whether it is convection or whether it is radiation, the user is not really concerned provided that he gets his heat transfer.

An experiment has been carried out recently in Holland in which oxygen enrichment was employed, and the amazing result was that if you merely replace some nitrogen in the air by some oxygen, this has no effect on the combustion of the fuel and it has no effect on the formation of soot, which I must say people thought it might. All it does is to raise the temperature of the flame.

Here is the point. In the furnace in which those concerned did the experiments they had a water-cooled sink, and the heat transfer to the water-cooled sink went up by 25%, but the heat transfer to the hot walls went up by nearly 40%, because when you have a flame and a charge which are near together in temperature, increasing the difference makes a much greater contribution to increased heat transfer than when the work is cold.

Mr. A. Higgs, Scottish Gas Board: On [p. 4] the authors have made reference to producer gas efficiency in terms of 90% for hot raw gas and 80% for cold clean gas respectively. These are evidently figures from producers which are running under full load and under optimum conditions and with expert supervision.

Production Efficiency

Investigations carried out from a town gas replacement aspect by our staff quite recently and separately by the National Industrial Fuel Efficiency Service produced figures for producer efficiency on mechanical grate producers varying from 55% to 76% on hot raw gas. The size of the units in question expressed in terms of town gas are from 25 mill. cu.ft. per annum to 1,000 mill. cu.ft. per annum. These efficiency figures, however, have no real bearing on the economics of town gas substitution. What really matters is the overall process of production efficiency. The inert content of producer gas—50% nitrogen—inevitably leads to a higher flue loss, and the last speaker has rather emphasised its effect on heat transfer. Its lower flame temperature means lower production speeds, while the lower flame speed can give instability at lower temperatures with incomplete combustion, and the air:gas ratio control is generally inferior.

These factors, coupled with variations in producer gas volume, the need to burn out and the hold-up in production while one is doing it, increased rejects in comparison with town gas, and greater demands on executive and manual supervision, collectively show gas to advantage for many applications.

This has, I think, been well brought out in the last few years in conversions which have been carried out in a number of industries in the Midlands and the North-West with financial savings to the consumers. We are at the moment converting 27 heat-treatment furnaces in a large forge operating from producer gas previously supplied from two mechanical producers. This will involve a load of 200 mill. cu.ft. per annum of town gas, and we expect to show a saving to the consumer of about £6,000 per annum.

In another case, the conversion of a large billet heating furnace from a direct producer using hot gas should show a saving by reducing costs from £6 per ton to £3 per ton. Other instances could be quoted in the wire industry.

There are logical explanations in all cases why this should be so—hours of use, 16 hours a day with eight-hour standbys in the case of the billet heating furnace and week-end stand-by, which all puts the cost up if you have your producer ticking over. It is the same in the wire industry. Indirect firing was employed. We put in direct firing by gas and got three times the output. In short, the point I am seeking to make is that initial costs based on producer gas efficiency only can often be misleading.

I should like to ask the authors whether they can suggest means of metering hot raw producer gas—because the question of comparative costs often arises—at 400°C. in a 2 ft. diameter refractory-lined duct without the difficulty of make-up affecting the accuracy. I should also like to ask them for their estimation of producer gas efficiency when operating at about one-third of maximum loading.

Mr. W. E. Francis, Midlands Research Station: The gas industry has a continuing interest in luminous flame radiation, which has led it to support the work of the International Flame Research Foundation at Ijmuiden. However, the results of this work are mainly of interest to users of large-scale furnaces in which high heat transfer rates are required to loads at temperatures of the order of 1,400-1,600°C. While there are many large town gas fired furnaces and also many operating at high temperatures, in the particular combination of large high temperature furnaces found in steel or glass melting, the overriding importance of fuel cost as a major proportion of the total cost of a low price product, makes it unlikely that a sufficiently great enhancement of the radiating properties of a town gas flame could be found to overcome the price disability. This does not prejudice anything that might happen in the future if gas prices are reduced. As the authors point out, attempts to increase the radiant output of a luminous flame tend to be frustrated, since the advantage gained on the 'swings' of emissivity is counteracted by the loss on the 'roundabouts' of temperature.

There still remains convection and there is undoubtedly scope for improving convective heat transfer. At the Midlands Research Station we have been concerned with exploiting one of the intrinsic merits of town gas, namely the ease with which high velocities of combustion products, at a temperature close to theoretical flame temperature, can be produced. These may be used to promote high convective heat transfer rates and to produce controlled recirculation and mixing of hot gases. Excess air is of course eliminated and the burners are highly controllable. Incidentally, by that means we completely eliminated all problems of combustion. We are not limited in any way by mixing rates of gas or fuel or by chemical reactions, so that we can concentrate entirely on the problems of heat transfer without reference to problems of combustion. Realisation of the maximum advantage with this method of firing in high temperature furnaces probably requires a complete rethinking of furnace design. Since combustion intensities of the order of 50 mill. B.t.u. per cu.ft. per hour are easily attainable, designers are virtually freed of the necessity of providing a combustion space.

Heat Transfer in Smoke Tubes

In the authors' section on heat transfer in smoke tubes, it is not clear how this treatment differs from standard heat exchanger design procedures. Mr. Thornton has already mentioned the work of the London Research Station on the immersion tube, and both the London and Midlands Research Stations have recently been working with some success on the similar but more complex problem of heat transfer and gas flow in tubes when the driving pressure is desired from the buoyancy of the hot gases.

Industrial gas engineers will agree wholeheartedly with the authors' statement on the wisdom of using small gas passages and high velocities with clean town gas combustion products. In fact this has been standard practice for many years in industrial gas appliances. Hot gas recirculating fans are used in the lower temperature range and air blast burners as jet pumps for high temperature gases, giving increased mass velocities and higher thermal efficiencies.

The authors' reference to the dewpoint meter takes my mind back to the Gas Research Board days. We found that the calibration curve, upon which Dooley and Whittingham's results were based, was considerably in error in the region of very low H_2SO_4 concentration of interest in town gas combustion. This conclusion was subsequently supported by independent experiments conducted by Rylands and Jenkinson, using a different method of dewpoint estimation. It therefore seems likely that Dooley and Whittingham's figure for the conversion of sulphur to sulphur trioxide in a town gas flame was a considerable overestimate.

Mr. Thurlow, replying to points in the discussion: There has been mention of Ijmuiden and the amount of work being carried out there of direct relevance to the gas industry. Two points occur to me. First of all the, International Flame Research Foundation is a democratic organisation, and its programme is decided by a committee. I know that Mr. Hayman has been fighting a very strong but rather lonely battle for the gas industry. If the gas industry wants more work carried out at Ijmuiden, it is up to it to press for it, and I think it could get it.

A side issue is that the Foundation has an advantage in the way that it collects information from different countries, and there is a good chance that some of the work in France, on natural gas for example—and they are building quite a large research station to study this—will filter through to the gas industry in this country via the International Flame Research Foundation.

Old Argument

Forced convection is something which I think is very important. It is one of the very old arguments in the steel industry, especially as no one really knows what the convection losses are with flames at high temperatures impinging on surfaces. I agree with Mr. Hayman that we want some work carried out on this subject.

The subject of the pneumatic pyrometer has been mentioned. I think that is something which is best left to the written reply. There has been some American work on a form of this instrument with a very small outside diameter developed for aircraft work which may be suitable for Watson House.

Mr. Gill, also replying to the discussion: I shall also leave most of the points to the written reply.

Mr. Higgs mentioned some rather startling efficiencies of 5 to 6% for producers running at low rating. He attributes this to high flue loss because of the high nitrogen content of the gas. He also asks what efficiencies we would expect when a producer such as we have quoted in the paper was operating at one-third of the maximum load. It would, of course, depend upon the particular plant and the length of main along which our gas was conducted. Provided that it was only a short length of main and that it was well insulated, we would not expect a marked drop in efficiency, but if there was a high loss of sensible heat from the gas the efficiency would drop quite a bit.

Refractory Venturi

Mr. Higgs also asked about developments in the metering of producer gas, and so on. I would mention that a refractory venturi has been used at one steelworks. The tappings have to be blown clear periodically, and some special kind of calibration is desirable, if this can be done, against the total throughput from the producer. If all the make gas from one producer can be led past the venturi, it simplifies calibration. At another steelworks, the pressure drop across a reversing meter is used with confidence as a means of metering the gas. This has been worked out in conjunction with a well-known instrument firm, and the results have been quite good.

SEAL CATALOGUE FROM MANCHESTER

A NEW comprehensive mechanical seal catalogue in which is described the full range of Flexibox balanced and unbalanced mechanical gland seals for all types of rotary shaft equipment, has been produced by a Manchester Company.

The catalogue has been primarily designed to provide mechanical seal users with a rapid means of selecting the correct type and size of seal for any given application. To this end, tables of essential dimensions, operating limits, power absorption and frictional heat development nomograms and details of P.V. ratings have been included. In addition, a recommended materials specification for seal components is given for more than 350 fluids.—*Flexibox Ltd., Nash Road, Trafford Park, Manchester, 17.*

Canadian expansion for control gear firm

EVERSHED & VIGNOLES LTD., instrument manufacturers and electronic instrumentation engineers of Chiswick, recently announced the re-organisation and enlargement of their Canadian activities by the formation of a new company, to be known as Evershed-Powertronic Ltd. The company will operate from Toronto and will provide a complete coast-to-coast specialist sales and service organisation for the installation of automatic electronic control equipment.

Contracts obtained

Another company, Evershed & Vignoles (Canada) Ltd. recently obtained contracts for important electronic control installations in Calgary, Vancouver, Newfoundland, Wabamun and other places. The ranges of Megger insulation testers and other electrical testing instruments manufactured by Evershed & Vignoles Ltd. will continue to be handled in Canada by R. H. Nichols Ltd., who have sole rights.—*Evershed & Vignoles Ltd., Acton Lane Works, Chiswick, London, W.4.*

Enlarged facilities at Walton-on-Thames

AFTER over 50 years of manufacturing high-power mercury arc rectifier equipment, the Hackbridge and Hewittic Electric Co. Ltd., of Walton-on-Thames, has enlarged its facilities to include the supply of rectifiers employing semi-conductor elements for low and medium voltage applications. The company also has in full production an extensive department for the complete manufacture, assembly, and testing of germanium diodes of the air cooled and water cooled types for use in Hewittic rectifiers.—*Hackbridge & Hewittic Co. Ltd., Walton-on-Thames, Surrey.*

A CONDUCTIVITY MEASURING BRIDGE FOR PRECISE WORK

THE development of low power consumption transistorised circuits, which operate from a small, long-life dry battery, has resulted in the production of a particularly compact and lightweight instrument, the Type MC-1 conductivity measuring bridge, produced by Electronic Switchgear (London) Ltd.

The scope of measurement with this instrument is wide. In the low conductivity region, the instrument is ideal for periodic routine checking of steam condensate, impurities in distilled and demineralised water, marine condenser leakage detection, and many other applications where minute traces of inorganic contaminating matter must be sensitively detected.

Trade News

Obviates inaccuracies

In the medium conductivity range, the instrument is useful for testing the content of total solids in boiler and cooling waters, also in washing and rinsing waters of all kinds. River pollution may also be measured with this instrument.

The Type MC-1 instrument embodies a precision A.C. measuring bridge which is energised at low potential by a transistor oscillator operating at 1,000 c.p.s.; this low potential high frequency bridge supply obviates inaccuracies which otherwise occur due to polarisation within the conductivity measuring cell. The output from the measuring bridge is amplified by a three-stage transistor amplifier, whereupon it is rectified and applied to a sensitive null balance indicator mounted centrally on the panel of the instrument; due to the high gain of the amplifier, the sensitivity of bridge balance is extremely precise throughout the wide range of measurement of the instrument—the accuracy of measurement is independent of the battery voltage and the amplifier parameters. — *Electronic Switchgear (London) Ltd., Letchworth, Herts.*

Pipework fabrication

A 24-PAGE brochure describing the activities in pipework fabrication of Charlton, Weddle & Co. Ltd., has recently been published.

Although established only two years ago, the company has already pioneered and introduced a number of new products, particularly in the shipbuilding industry. The company is also actively engaged on industrial installations, and a product primarily designed for marine applications, but finding a wide acceptance in refinery, steam raising and chemical plant pipework is the Nobol boltless pipeclip:—*Charlton, Weddle & Co. Ltd., Manor Works, Newcastle-upon-Tyne 1.*

Monobloc centrifugal pump range addition

WORTHINGTON-SIMPSON Ltd., of Newark, Notts, announce an addition to their already extensive range of versatile Monobloc centrifugal pumps.

The new range is designated type D.O. and comprises open impeller type pumps specially designed to handle slurries, paper stock, liquids containing small solids, and viscous liquids as well as clear liquids.—*Worthington - Simpson Ltd., Lowfield Works, Newark, Notts.*

Temperature control by Ether

ETHER LTD. have now extended their range of Transitrol temperature controllers to a total of six with the introduction of a continuously-acting proportional controller with reset feature, known as the Type 995.

This instrument, which has a 7-in. indicating scale, operates in conjunction with a proportioning motorised valve and affords proportional control, to very close accuracy, on gas or oil-firing applications. It can also maintain steam at a constant pressure under varying loads.

Temperature control is attained by the use of a conventional galvanometer as the measuring system. An indicator-pointer operates a simple photo-electric system which, in turn, controls the valve-positioning motor. The latter is powered by a 24 V 50 cycles, shaded-pole, reversing motor comprising two stators and two rotors, coaxially mounted on a common shaft which transmits power to the final drive shaft through a silent gear train.

The entire instrument, which is suitable for wall or panel-mounting, is designed as a plug-in unit and is easily withdrawn from its casing.

The manufacturers announce that the proportional control and manual reset, featured in the Type 995, are also available on the well-proven Transitrol Type 994 programme controller, which indicates and controls temperature to a predetermined time programme. In addition, Ether Ltd. state that the motor linkage can be attached to any mechanism to which it is desired to add the refinement of proportional control.—*Ether Ltd., Caxton Way, Stevenage, Herts.*

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EDUCATIONAL

THE UNIVERSITY OF LEEDS

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APPLICATIONS are invited for the above scholarship of a value of £350 a year. The scholarship is provided to enable promising students to follow an Honours course in either Gas Engineering or Chemical Engineering as preliminary training for entry into the Gas Plant Industry.

The scholarship is open to applicants of British nationality from school or from industry; among the latter preference will be given to candidates already engaged in the Gas Plant Industry.

Applications should reach the Registrar, The University, Leeds, 2, from whom further particulars and forms of applications may be obtained, not later than January 31, 1960.

THE UNIVERSITY OF LEEDS

CHARLES BROTHERTON SCHOLARSHIP IN CHEMICAL ENGINEERING OR GAS ENGINEERING

APPLICATIONS are invited for the above scholarship of the annual value of £125 a year, provided to enable promising students to follow an honours course in chemical engineering or gas engineering in the Department of Coal Gas and Fuel Industries with Metallurgy. In cases where the candidates reach the required standard, the scholarship may be supplemented by a State Scholarship awarded by the Ministry of Education.

The scholarship is open to applicants of British nationality from school or industry, who are qualified to enter upon a degree course.

Applications should reach the Registrar, from whom further particulars and forms of applications may be obtained not later than January 31, 1960.

APPOINTMENTS VACANT

WALES GAS BOARD
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APPLICATIONS are invited for the above-mentioned position.

The successful applicant must have had good experience in gasworks practice and be capable of handling special investigations and the chemical control of plant.

Applicants should hold the Higher Grade Certificate of the Institution of Gas Engineers (Manufacture), or an equivalent qualification, and the salary will be within the range of £827 to £1,002 per annum.

The successful applicant will be required to pass a medical examination and to join the Board's Staff Pension Scheme.

Applications stating age, experience and qualifications, together with the names of two referees, should be addressed to the Undersigned to be received not later than January 9, 1960

J. POWDRILL,
General Manager & Engineer.

Bute Terrace,
CARDIFF.

WALES GAS BOARD
CARDIFF UNDERTAKING

DEPUTY STATION ENGINEER

APPLICATIONS are invited for the above-mentioned position at Grangetown Gasworks where a major reconstruction and extension programme is in hand.

Candidates must have had considerable experience in the control of a large gas production station and be a Corporate Member of the Institution of Gas Engineers.

The successful candidate will be required to actively participate in the development of various projects now in hand, with the purpose of taking over when the present Station Engineer retires in 15 months' time.

The salary offered is within the range £981 to £1,235 per annum. The post is pensionable and subject to a medical examination. Housing accommodation is available at a reasonable rental.

Applications stating age, experience and qualifications, together with the names of two referees, should be addressed to the Undersigned to be received not later than January 9th, 1960.

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Candidates should have had extensive experience in the operation of continuous vertical retorts and automatic carburetted water gas plants and in the supervision of staff and labour. Corporate Membership of the Institution of Gas Engineers is an essential qualification.

A flat adjacent to the Gas Works may be available as temporary accommodation at a reasonable rental.

The salary for the appointment which is pensionable and subject to medical examination will be within the range of £1,195 to £1,355 per annum.

Applications stating age, experience and qualifications, together with the names of two referees should be addressed to the Industrial Relations Officer, West Midlands Gas Board, 6, Augustus Road, Edgbaston, Birmingham 15, **to reach him not later than January 7, 1960.**

WEST MIDLANDS GAS BOARD
WOLVERHAMPTON DIVISION

VACANCY FOR
WORKS CHEMIST, TIPTON WORKS

CANDIDATES must possess the Higher National Certificate in Chemistry and have some years' experience in the chemical control of Gas Works Plant.

The salary for the appointment, which is pensionable and subject to medical examination, will be within the range of £733-£813 per annum.

Applications, stating age, experience and qualifications, together with the names of two referees, should be addressed to Mr. Stanley Jones, Divisional General Manager, West Midlands Gas Board, Kensington House, Bath Street, Dudley, **to reach him not later than January 7th, 1960.**

WEST MIDLANDS GAS BOARD
WARWICKSHIRE DIVISION

VACANCY FOR
HOME SERVICE ADVISER

LEAMINGTON AND WARWICK DISTRICT

CANDIDATES should have experience in domestic science and hold an appropriate diploma. They should be capable of working independently, of conducting cookery and laundry demonstrations using gas appliances and also have had experience in Home Service work.

The salary for the appointment, which is pensionable and subject to medical examination, will be within the range of £503-£614 per annum.

Applications, stating age, education, qualifications and experience, should be addressed to Mr. A. Allen, Divisional General Manager, West Midlands Gas Board, Gas Street, Coventry, **to reach him not later than December 31, 1959.**

WEST MIDLANDS GAS BOARD
BIRMINGHAM & DISTRICT DIVISION

VACANCY FOR
DRAUGHTSMAN
DISTRIBUTION DEPARTMENT, LORD STREET

THE main duties involve the preparation of detail and arrangement drawings in connection with Compressing, Governing and Storage Plant and the plotting of information relating to mains and service laying work. A knowledge of surveying will be an advantage.

Candidates should preferably possess a National Certificate or equivalent qualification.

The salary for the appointment, which is pensionable and subject to medical examination, will be within the range of £733-£813 per annum.

Applications, stating age, experience and qualifications, together with the names of two referees, should be addressed to Mr. J. E. Wakeford, Divisional General Manager, West Midlands Gas Board, Edmund Street, Birmingham, 3, **to reach him not later than January 7, 1960.**

PROJECT ENGINEER required for old-established Company in Yorkshire. The work is concerned with controlled atmosphere generators and gas drying equipment, and the project engineer would be responsible for the design, installation and subsequent testing of new plant and the work would involve some time spent on site.

Candidates should have a technical qualification in chemical engineering or fuel technology preferably to degree standard. Superannuation scheme and other benefits. Salary by arrangement.

Write in first instance giving brief details of experience to Gas Handling Division, W. C. Holmes & Co., Ltd., Turnbridge, Huddersfield.

EASTERN GAS BOARD
(NORWICH DIVISION)

HOME SERVICE ADVISER—KING'S LYNN DISTRICT

APPLICATIONS are invited for the position of Home Service Adviser in the Norwich Division of the Board, to be based at King's Lynn.

Candidates should have had at least two years' training in Domestic Science with an appropriate Diploma and be capable of conducting cookery and laundry demonstrations, using gas appliances. The successful applicant will also be required to maintain and foster good relations with Women's Organisations, Education Authorities, commercial and catering establishments, and will be called upon to visit people in their own homes to sell and advise on the use of gas appliances. From time to time it will be necessary to assist in the Showrooms for the purpose of selling.

The commencing salary will be within Grades A.P.T. 3 or 4 (£448 to £603 per annum or £468 to £622 per annum) of the National Joint Council for Gas Staffs (Provincial 'A' Salary Scales, the initial placing being dependent upon experience and qualifications.

The successful applicant will be required to pass a medical examination, and unless already subject to a Pension Scheme by virtue of the Gas (Pension Rights) Regulations 1950, will be required, if eligible, to join the Eastern Gas Board Staff Pension Scheme within six months of taking up the appointment.

Applications, giving details of age, qualifications, and experience, should be sent to the Divisional Manager (marked "Confidential"), Eastern Gas Board, Norwich Division, Thorpe Lodge, 1, Yarmouth Road, Norwich, N.25, to arrive not later than January 30, 1960.
(Adv. No. 9)